Chapter 9
Schedule

This chapter identifies the target completion dates for protocols still to be developed, identifies tasks that need to be completed in support of those protocols, and summarizes the frequency of sampling for protocols that will be implemented in 2007. Our approach to the implementation of monitoring in SWAN is to **start slowly, focus on a small number of projects, and be prepared to make adjustments.** During the early years of the program, it is important not to overburden Network and park staff with overzealous plans to take on too much to quickly and discover that your program has overshot its capabilities.

Integrated ecosystem monitoring can be viewed as hierarchical and occurring at multiple levels (tiers) based on scale of resolution and rates of change (Figure 9-1). Temporally and spatially continuous monitoring (Tier 1) is usually conducted by satellite remote sensing or aerial photography and is directed at broad landscape-scale patterns of change. Frequent multipoint ground-based monitoring using probabilistic sampling designs (Tier 2) are used to document status or change in a resource or to provide ground verification of remotely sensed parameters in Tier 1. Finally, the most frequent monitoring and intensive sampling (Tier 3) occurs at a limited number of smaller intensively monitored areas for the purpose of determining cause and effect relationships, the status of a harvested resource, or to understand how processes interrelate.

Implementation of vital signs monitoring will be phased in over 5 yr beginning in 2006 (Table 5-1). Most Tier 1 vital signs monitoring will be implemented first because these protocols provide important context for ground-based monitoring that will follow and they are likely to be the least expensive to conduct. Protocols for monitoring glacial ice extent and landscape processes (snow-cover date and snow-free date, extent and duration of ice cover, timing and degree of lake turbidity) were developed in 2005 and will be tested in 2006. Simultaneously, we will develop and test protocols for monitoring water quality and resident lake fish.

Throughout the 5-yr implementation phase, draft protocols will be written, field-tested for 1–2 yr, submitted for peer review, and finalized. Some key questions that need to be answered during protocol testing include: Are there problems with methods or equipment? Do procedures require too much time or staff? Are standard operating procedures (SOPs) for data collection and management too complex? How can the protocols be made more efficient? We anticipate that in many cases pilot monitoring, including tests of data management SOPs, will reveal the need for changes in protocol design.

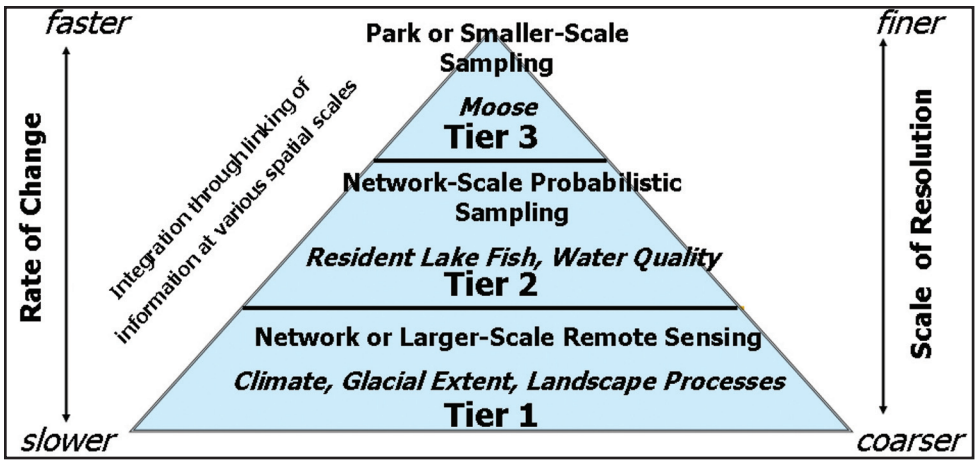

Figure 9-1 *Temporal and spatial considerations as they relate to implementation of SWAN vital signs monitoring. Protocols for vital signs monitored by remote sensing (Tier 1) will be developed and implemented during the first years of the program.*

Expected implementation dates for final protocols and key tasks associated with the development of protocols are summarized in Table 9-1. In many cases these tasks reflect the fact that SWAN is working with a range of Network partners to collectively develop monitoring protocols. The success of our program may hinge upon our ability to work efficiently and effectively with other programs that complement SWAN.

Table 9-1 *Summary of tasks to be completed for protocol development or for acquiring existing data, SWAN Vital Signs Monitoring Program.*

Protocol Finalization Date	Vital Sign (Protocol Category)	Issues to be Addressed During Protocol Development and Testing
2008	**Geomorphic Coastal Change**	Conduct a cost and methods comparison for the use of global positioning system ground surveys, aerial LIDAR, videography, and aerial photo analysis. Identify other shoreline change monitoring programs that may be able to cost-share with the Network.
	Marine Nearshore-Kelp & Eelgrass	Aerial surveys for canopy coverage need to be evaluated to develop a SWAN/GEM protocol that will allow data on kelp and eelgrass to be incorporated into a Gulf of Alaska database.
	Marine Nearshore-Marine Intertidal Invertebrates	Recent intertidal invertebrate inventories (2004–05) have helped characterize the benthic community in Network parks and will be used to develop a SWAN/GEM sampling approach.
	Marine Nearshore-Seabirds	The interagency Alaska Predator Ecosystem Experiment developed a long-term monitoring strategy for seabirds in the Exxon Valdez spill area. This strategy will be adapted to a SWAN/GEM protocol.
	Marine Nearshore-Black Oystercatcher	Techniques for monitoring black oystercatchers are well established and have been applied at KEFJ. This information will be used to develop a SWAN/GEM protocol that will allow data on oystercatchers to be incorporated into a Gulf of Alaska database.
	Marine Nearshore-Sea Otter	Aerial strip transect survey methods for sea otter are well established. The SWAN nearshore needs to be delineated into density strata based on distance to shore and bathymetry.
	Marine Nearshore-River Otter	Ongoing research is attempting to establish whether population levels and trends of river otters can be monitored among various coastal shoreline habitats by recording the use of latrine sites and scat deposition rates.
	Marine Nearshore-Water Chemistry	Several programs are conducting hydrographic observations offshore of SWAN parks from both hydrographic transects and moorings. Work will focus on developing a process to acquire and use this existing data. An SOP needs to be developed for measuring seasonal intertidal water temperature.
	Freshwater Chemistry	Select a subset of larger lakes for more intensive routine sampling. Determine sampling interval based on natural variability of parameters in relation to climate, season, and discharge data.
	Salmon	Techniques for monitoring adult salmon are well established by ADF&G and cooperatively in use by SWAN parks. Work will focus on database development.
	Air Quality	A data management protocol is needed to acquire and utilize data from the IMPROVE stations on/near the coasts of ANIA and LACL.
2009	**Weather and Climate**	Weather station configuration and design will be finalized based on testing of a prototype station on the Harding Ice Field. Conduct field reconnaissance of potential sites identified by climatic modeling.

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Table 9-1 (continued)

Protocol Finalization Date	Vital Sign (Protocol Category)	Issues to be Addressed During Protocol Development and Testing
2009	**Vegetation Composition and Structure**	Traditional techniques for determining vegetation community analysis generally involve plot-based fieldwork. SWAN will investigate how to use a combination of IKONOS satellite-type data and plot-based fieldwork to detect changes in subtle natural systems.
	Sensitive Vegetation Communities	Standard techniques for plot-based sampling are well established, involving permanent markers and repeated visits. Determine how to array plot sampling (temporal and spatial) to detect change in community composition in small-scale communities that are sensitive to environmental change.
	Land Cover and Land Use	Techniques for multispectral classifications are well established and used for vegetation mapping and detection of drastic land use changes. Most previous change detection work with satellite data involves drastic changes such as fires, logging, and agriculture. It is necessary to determine how to use Landsat satellite-type data to repeatably map and describe land cover classes and such changes as herbaceous to woody or forested types, large-scale disturbances such as insect outbreaks or deglaciation, and human-caused changes on neighboring lands.
	Volcanic & Earthquake Activity	The Alaska Volcano Observatory and West Coast/Alaska Tsunami Warning Center operate recording stations throughout southwestern Alaska and provide continuous data on volcanic and earthquake activity. Work will focus on developing a process to acquire and used this existing data.
	Insect Outbreaks	The ADNR conducts aerial surveys each summer jointly with the USFS to assess forest condition statewide. Work will focus on developing a process to acquire and use existing data.
	Harbor Seal	Techniques for monitoring harbor seals are well established by NMFS and in practice in the northern Gulf of Alaska. Work will focus on developing a process to acquire and use existing data.
	Surface Hydrology	Design and testing is needed to develop relationships between water levels of core lakes sampled for water chemistry and discharge of outlet streams. It is also necessary to evaluate manually collected records of water level versus use of an analogue or digital data recorder.
	Brown Bear	Line-transect double-count aerial survey techniques are used in the interior of SWAN parks to obtain brown and black bear density estimates. Work is needed to assess the application of this technique at concentration sites such as coastal salt marshes. Develop a process to acquire defense of life and property bear killing data from the Bear-Human Information Management System maintained by the NPS-ARO.
	Visitor Use	Research will be implemented in 2006 to determine how best to count remote and dispersed visitors in SWAN. Focus will be on backcountry areas and involve all users. A final component of this project will include development and testing of a protocol.

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Table 9-1 (continued)

Protocol Finalization Date	Vital Sign (Protocol Category)	Issues to be Addressed During Protocol Development and Testing
2009	**Invasive/Exotic Species**	Network staff will work with the Exotic Plant Management Team from the ARO as they develop a monitoring program for exotic plants and animals in the parks to ensure compatibility of objectives, data collection, and analyses.
2010	**Wolf and Wolverine**	Techniques for monitoring wolves and wolverines using sample unit probability estimation are well established by the ADF&G but need to be tested in areas with unstable late-winter snow conditions such as LACL and KATM.
	Moose	Techniques for monitoring moose are well established by ADF&G and cooperatively in use by SWAN parks. Work will focus on developing a sightability model for KATM and development of a database.
	Caribou	Techniques for annual monitoring of caribou are well established by ADF&G and cooperatively in use by ANIA, KATM, and LACL. Work will focus on developing a process to acquire and use existing data.
	Bald Eagle	Techniques for monitoring bald eagles are well established by USFWS and in use by some SWAN parks. Work will focus on supplementing existing survey strata with randomly chosen quadrats and selecting a stratified random sample of quadrats to be surveyed at 1–3 year frequencies.
	Resource Harvest	Harvest records are collected by the State of Alaska and USFWS through community profile surveys. Work will focus on developing a process to acquire and use existing data.

The timing and frequency of monitoring is guided by the spatial and temporal patterns of variance in the parameters being measured and by the information desired. The limited resources of SWAN and the large spatial expanse of the parks prohibit routine measurements at high frequencies (i.e., daily or hourly) or close spatial intervals. Measurements will be made at intervals of time and space that allow the detection of large-scale changes in physical processes and smaller scale biotic responses among adjacent years and in adjacent locations. For example, frequency of monitoring for projects implemented in 2007 will range from once per decade or longer for glacial extent to weekly for selected landscape processes (Table 9-2).

***Table 9-2** Frequency and timing of sampling for vital signs to be monitored by SWAN in 2007.*

Vital Sign and Metrics	Sample Interval	January	February	March	April	May	June	July	August	September	October	November	December
Glacier Extent													
Areal Extent	Decadal												
Terminus Photography	Decadal												
Landscape Processes													
Ice-Cover Date and Ice-Free Date	Weekly												
Extent and Duration of Snow Cover	Weekly												
Timing and Degree of Lake Turbidity	Weekly												
Seasonal Productivity, Leaf-On	Weekly												
Resident Lake Fish													
Species Richness and Species Turnover	Every 3–5 years												